

Application No. 10/619,868
Amendment Dated September 9, 2004
In response to Office Action Dated May 14, 2004

Listing of Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1. (Currently Amended) A level detector comprising:

a transparent housing;

a plurality of light emitting devices in the housing arranged along a direction which is substantially upright in use of the detector; and

a plurality of light receiving devices in the housing and also arranged along said direction, each light receiving device being operable to receive light via respective light paths from at least two adjacent light emitting devices if the light is from at least one light emitting device which has been internally reflected by the housing in dependence, which depends on the refractive index of the fluid surrounding the housing; and

a circuit coupled to the light emitting devices and the light receiving devices and arranged such that it can determine whether light is received via each of said light paths to each light receiving device;

whereby the extent of immersion of the level detector within a liquid can be determined ~~from the outputs of the light receiving devices;~~ by said circuit;

~~wherein each light receiving device can receive light emitted by each of two adjacent light emitting devices and internally reflected by the housing.~~

Claim 2. (Currently Amended) A level detector comprising:

a transparent housing;

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a plurality of light emitting devices in the housing arranged along a direction which is substantially upright in use of the detector; and

a plurality of light receiving devices in the housing and also arranged along said direction, each light ~~receiving~~ emitting device being operable to ~~receive light from~~ illuminate, via respective light paths, each of at least two adjacent light receiving devices if the light is one light emitting device which has been internally reflected by the housing, which depends in dependence on the refractive index of the fluid surrounding the housing; and

a circuit coupled to the light emitting devices and the light receiving devices; and arranged such that it can determine whether light is received via each of said light paths from each light emitting device;

whereby the extent of immersion of the level detector within a liquid can be determined ~~from the outputs of the light receiving devices; and~~

~~wherein each light emitting device can illuminate each of two adjacent light receiving devices by means of light which is internally reflected by the housing by said circuit.~~

Claim 3. (Currently Amended) A level detector as claimed in claim 2, wherein each light receiving device can receive light via respective light paths from emitted by each of two adjacent light emitting devices and if the light is internally reflected by the housing, and wherein said circuit can determine whether light is received via each light path to each light receiving device.

Claim 4. (Canceled)

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Claim 5. (Canceled)

Claim 6. (Canceled)

Claim 7. (Currently Amended) A level detector comprising:

a transparent housing;

a plurality of light emitting devices in the housing arranged along a direction which is substantially upright in use of the detector;

a plurality of light receiving devices in the housing and also arranged along said direction, each light receiving device being operable to receive light from at least one light emitting device which has been internally reflected by the housing in dependence on the refractive index of the fluid surrounding the housing;

whereby the extent of immersion of the level detector within a liquid can be determined from the outputs of the light receiving devices; and

a control circuit for deriving a reading from a light ~~emitting~~ receiving device, the reading being dependent upon the relationship between an ambient measurement taken when no light emitting device is illuminating the light receiving device and an operational measurement taken when a light emitting device capable of illuminating the light receiving device is operating.

Claim 8. (Currently Amended) A level detector as claimed in claim 7,
wherein said~~comprising:~~

~~a transparent housing;~~

~~a plurality of light emitting devices in the housing arranged along a direction which is substantially upright in use of the detector;~~

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~~a plurality of light receiving devices in the housing and also arranged along said direction, each light receiving device being operable to receive light from at least one light emitting device which has been internally reflected by the housing in dependence on the refractive index of the fluid surrounding the housing;~~

~~whereby the extent of immersion of the level detector within a liquid can be determined from the outputs of the light receiving devices; and~~

a control circuit ~~comprising~~ comprises a memory storing calibration data, the calibration data comprising values associated with respective light emitting devices and/or light receiving devices and/or light paths between emitting and receiving devices, and means operable to determine whether respective parts of the level sensor are immersed in dependence upon the outputs from the emitters and associated calibration data.

Claim 9. (Original) A level detector as claimed in claim 8, wherein the calibration data comprises at least one value for each light path and associated emitting device and receiving device.

Claim 10. (Canceled)

Claim 11. (Currently Amended) A level detector as claimed in claim ~~10~~ 8, the control circuit being operable to determine, using calibration data, an ambient reading and an operational reading, whether a respective part of a level sensor is one of at least (a) fully immersed, (b) partially immersed or (c) not immersed in the liquid.

Claim 12. (Currently Amended) A level detector as claimed in claim-~~10~~8, the control circuit being operable to determine, using calibration data, an ambient reading and an operational reading, whether a respective part of a level sensor is dirty.

Claim 13. (Original) A level detector comprising:
a transparent housing;
a plurality of light emitting devices in the housing arranged along a direction which is substantially upright in use of the detector;
a plurality of light receiving devices in the housing and also arranged along said direction, each light receiving device being operable to receive light from at least one light emitting device which has been internally reflected by the housing in dependence on the refractive index of the fluid surrounding the housing; and
a control circuit operable to determine, from the outputs of the light receiving devices, the extent of immersion of the level detector within a liquid by locating the highest sensor whose output indicates immersion and checking that at least one lower sensor also has an output indicating immersion.

Claim 14. (Original) A level detector as claimed in claim 1, wherein the housing has an internally-reflecting surface which is substantially continuous and straight along said direction.

Claim 15. (Currently Amended) A level detector as claimed in claim-~~13~~14, wherein the outer profile of the housing, when considered transverse to said direction, is substantially uniform throughout the distance over which level sensing takes place.

Claim 16. (Canceled)

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Claim 17. (Canceled)

Claim 18. (Previously Presented) A level detector as claimed in claim 11, the control circuit being operable to determine, using calibration data, an ambient reading and an operational reading, whether a respective part of a level sensor is dirty.

Claim 19. (New) A level detector as claimed in claim 13, the control circuit being operable to determine the extent of immersion by performing a search procedure involving checking whether an intermediate level is immersed and then checking alternately higher and lower levels.